

SPECIATION IN DIATOMS: RECENT INSIGHTS, NEW PARADIGMS?

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Diatoms are one of the most species-rich and productive groups of micro-algae in the world's lakes and oceans. They are also characterized by a peculiar diplontic life cycle involving gradual size reduction during vegetative divisions and rapid size restitution, mostly as a result of sexual reproduction. Diversification is most pronounced in the raphid pennate diatom clade, a largely benthic group which despite its relatively young geological age (probably late Cretaceous) accounts for the majority of the over 200.000 diatom species estimated to exist. This enormous diversity is puzzling, as current paradigm holds that since dispersal in microbes is ubiquitous, allopatric speciation must be strongly impeded due to global gene flow. Virtually nothing however is known about alternative speciation mechanisms. Here we present evidence, based on population-genetic and community-level studies on freshwater and marine raphid pennate diatoms, that allopatric processes may yet play an important role in diatom speciation. We show that gene flow between distant populations of marine and freshwater diatoms is restricted and displays a strong isolation by distance pattern. In addition, we show that communities of freshwater diatoms display the same regional and global biogeographical patterns as plants and animals, and that these have been shaped not only by contemporary environmental factors but also by climatic and geological events in the past. Finally, while little is known about the actual underlying molecular and genetic mechanisms driving speciation in diatoms, the recent discovery of a sophisticated density-dependent but environment-independent pheromone production-perception system in pennate diatoms suggests that pre-gametic reproductive isolation may play an important role in diatom speciation.